



Lessons Learned from Monitoring Bioretention Swales in West Seattle's High Point Neighborhood

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Presentation Overview

- 🌿 Overview of High Point redevelopment project
- 🌿 Description of High Point bioretention swales
- 🌿 Description of High Point bioretention monitoring design
- 🌿 Results from water year 2007 and 2008 monitoring
- 🌿 Lessons learned
- 🌿 Expanded monitoring

High Point Redevelopment Project

 In 2003, the Seattle Housing Authority took the lead in implementing a six year project to redevelop the High Point Neighborhood in West Seattle



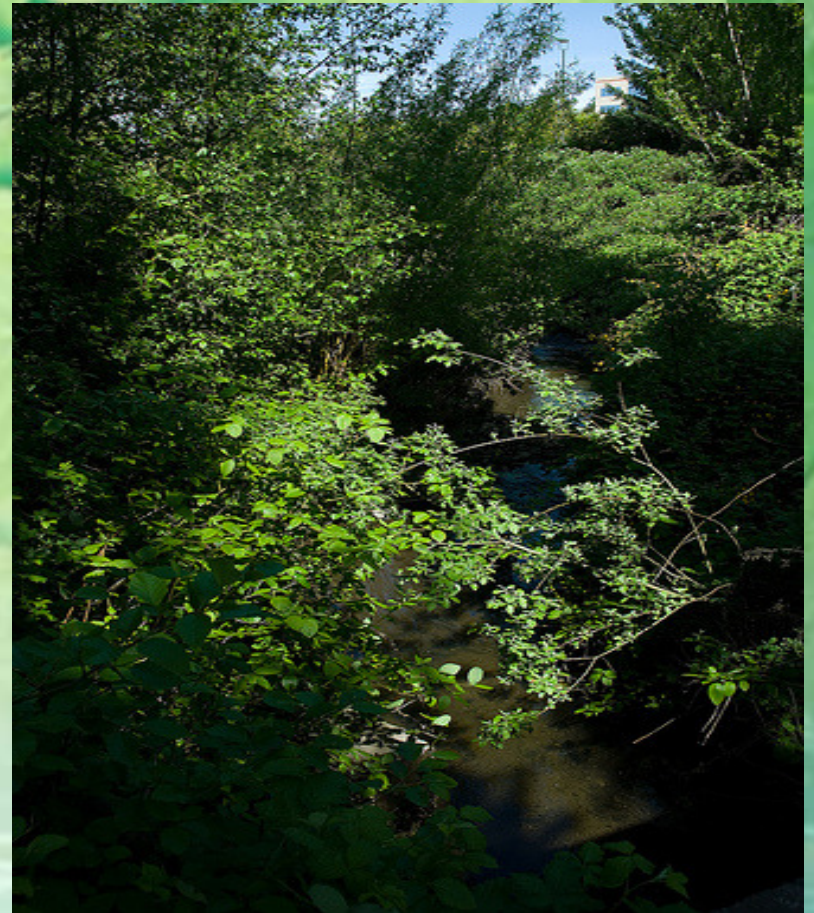
High Point Redevelopment Project

🌿 When completed, High Point will have 1,600 new affordable and market-rate units across its 120 acres, making it Seattle Housing Authority's largest site



High Point Redevelopment Project

🌿 Project will double the housing density and double the impervious surface for the High Point sub-basin of Longfellow Creek



High Point Redevelopment Project



🌿 A primary feature of the High Point redevelopment project is over 11,000 linear feet of bioretention swales

Bioretention Diagram from the Low Impact Development Technical Guidance Manual for Puget Sound

2. Bioretention cell: Prince George's County, Maryland

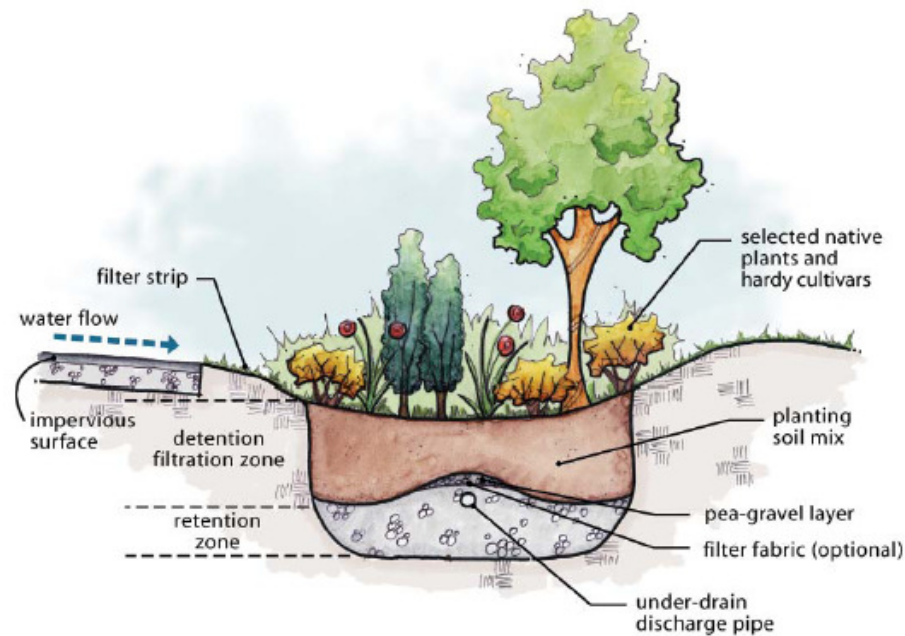
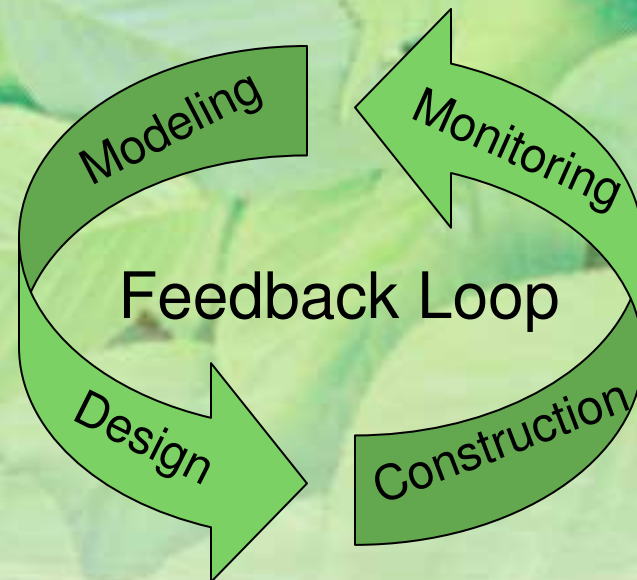


Figure 2 Bioretention design with elevated under-drain and fluctuating aerobic/anaerobic zone.
Graphic by AHBL Engineering

High Point Bioretention Swale Monitoring Goal

🌿 Monitor bioretention swales to create a feedback loop to the design engineer that would improve the design and lower costs for future retrofits



High Point Bioretention Swale Monitoring Funding

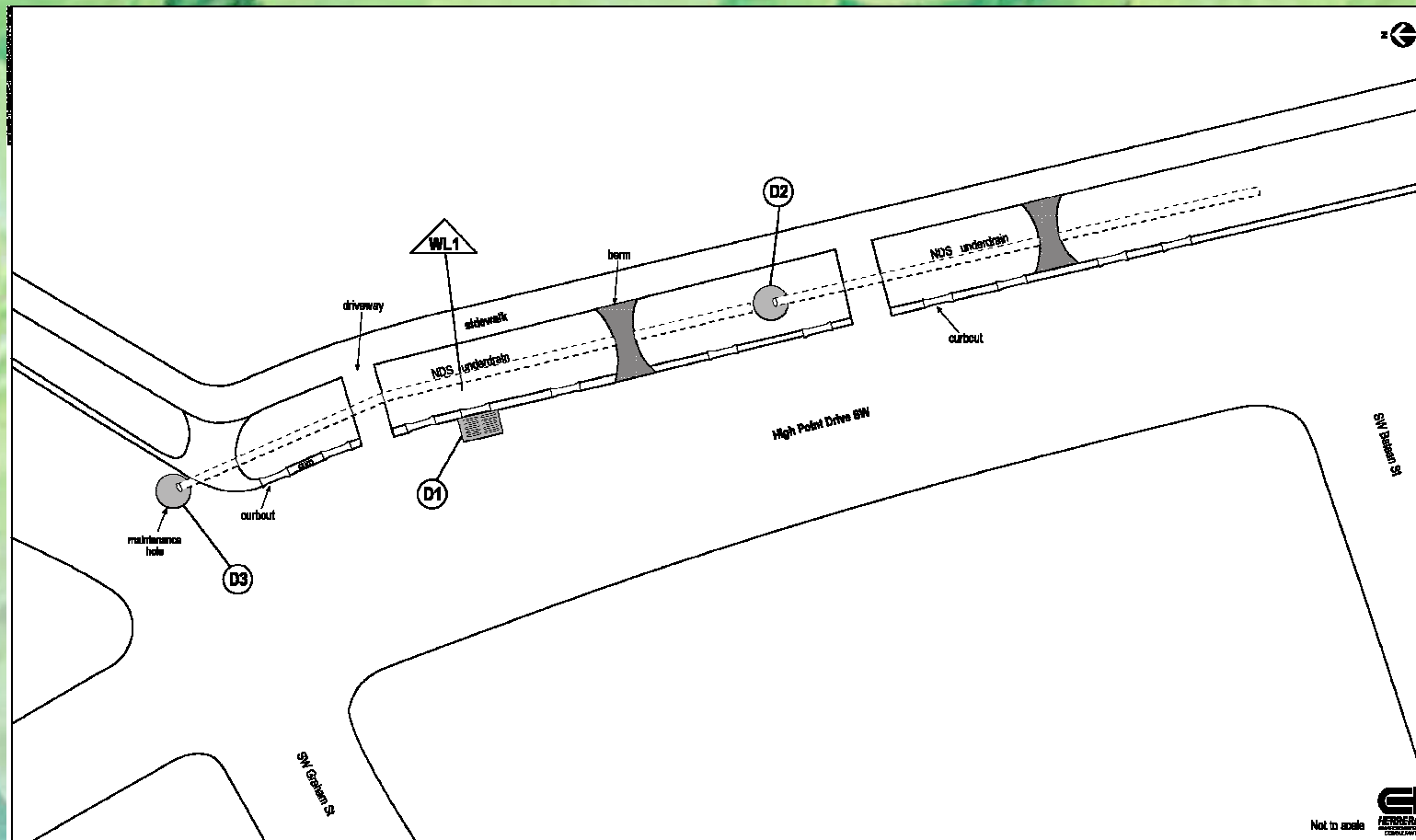
- 🌿 Seattle Public Utilities
- 🌿 Washington State Department of Ecology
- 🌿 U.S. Environmental Protection Agency – congressional earmark funding



High Point Bioretention Swale Monitoring Design

- ❖ Three year project
- ❖ Monitoring elements
 - ❖ Controlled infiltration testing on two occasions
 - ❖ Continuous monitoring:
 - ❖ Discharge from underdrain system
 - ❖ Ponding depth
 - ❖ Precipitation
 - ❖ HSPF model calibration monitoring

High Point Bioretention Swale Monitoring Location and Site Plan



Infiltration Testing

✿ Design Assumptions

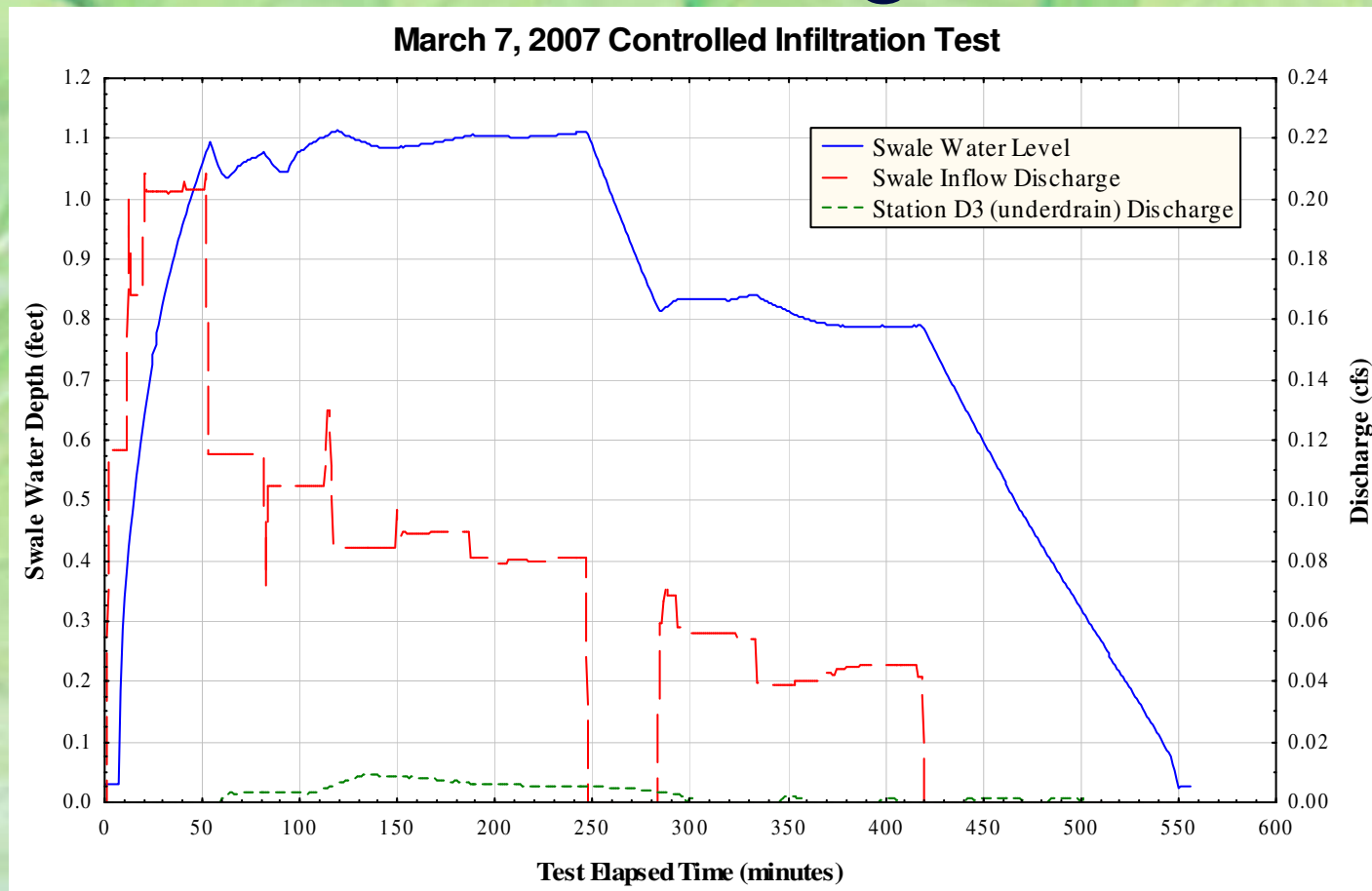
- ✿ The infiltration rate for the engineered soil layer was assumed to be **2 inches/hour** based on results from laboratory testing (ASTM D 2434: Standard Test Method for Permeability of Granular Soils).

Infiltration Testing



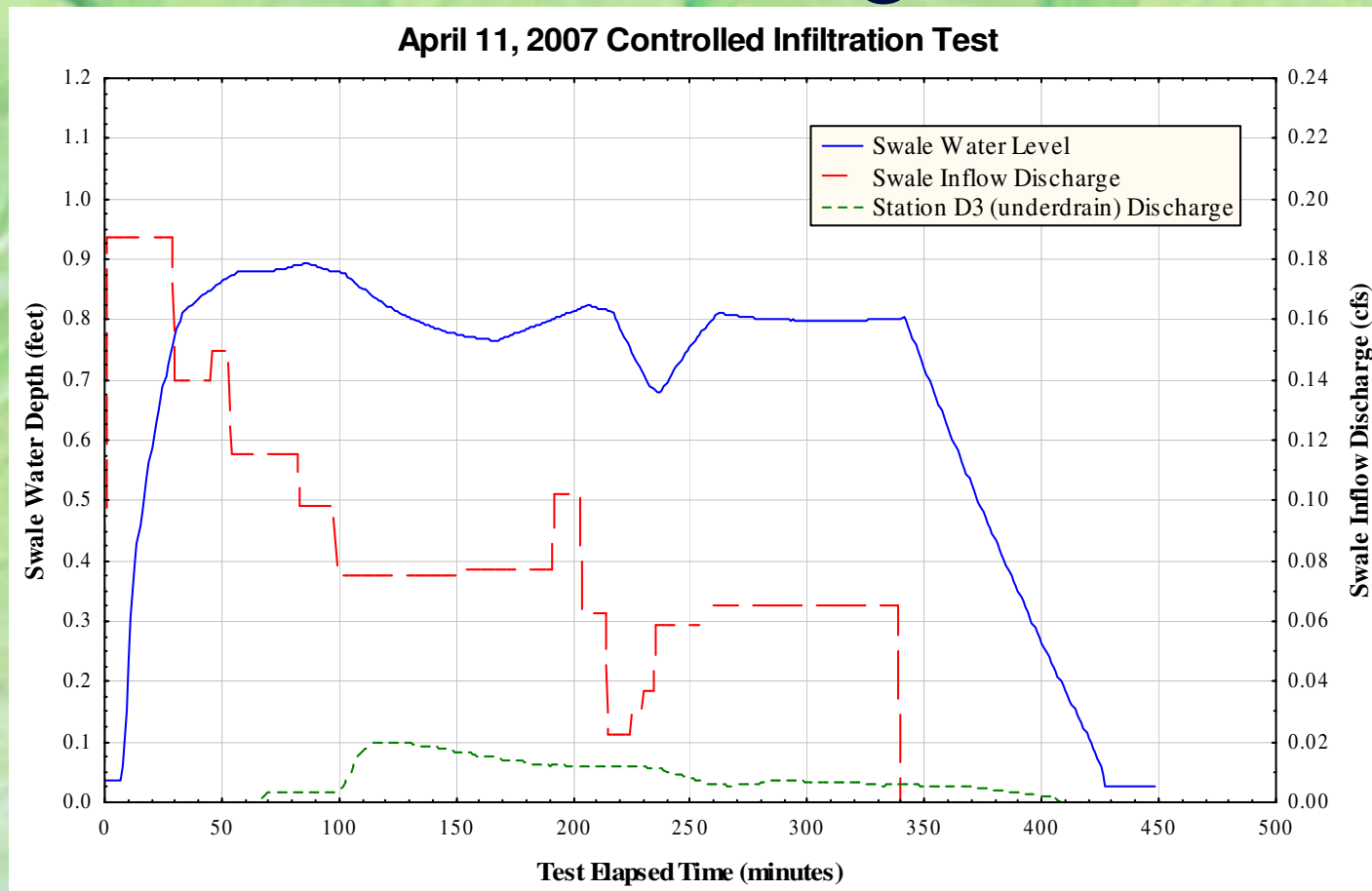
- 🌿 Surface infiltration rates to the NDS swale were measured on two occasions (March 7 and April 11, 2007)
- 🌿 Used infiltration test method adapted from the Washington State Department of Ecology's procedure for pilot infiltration testing.

Infiltration Testing



Calculated Infiltration Rate = **4.2 inches/hour**

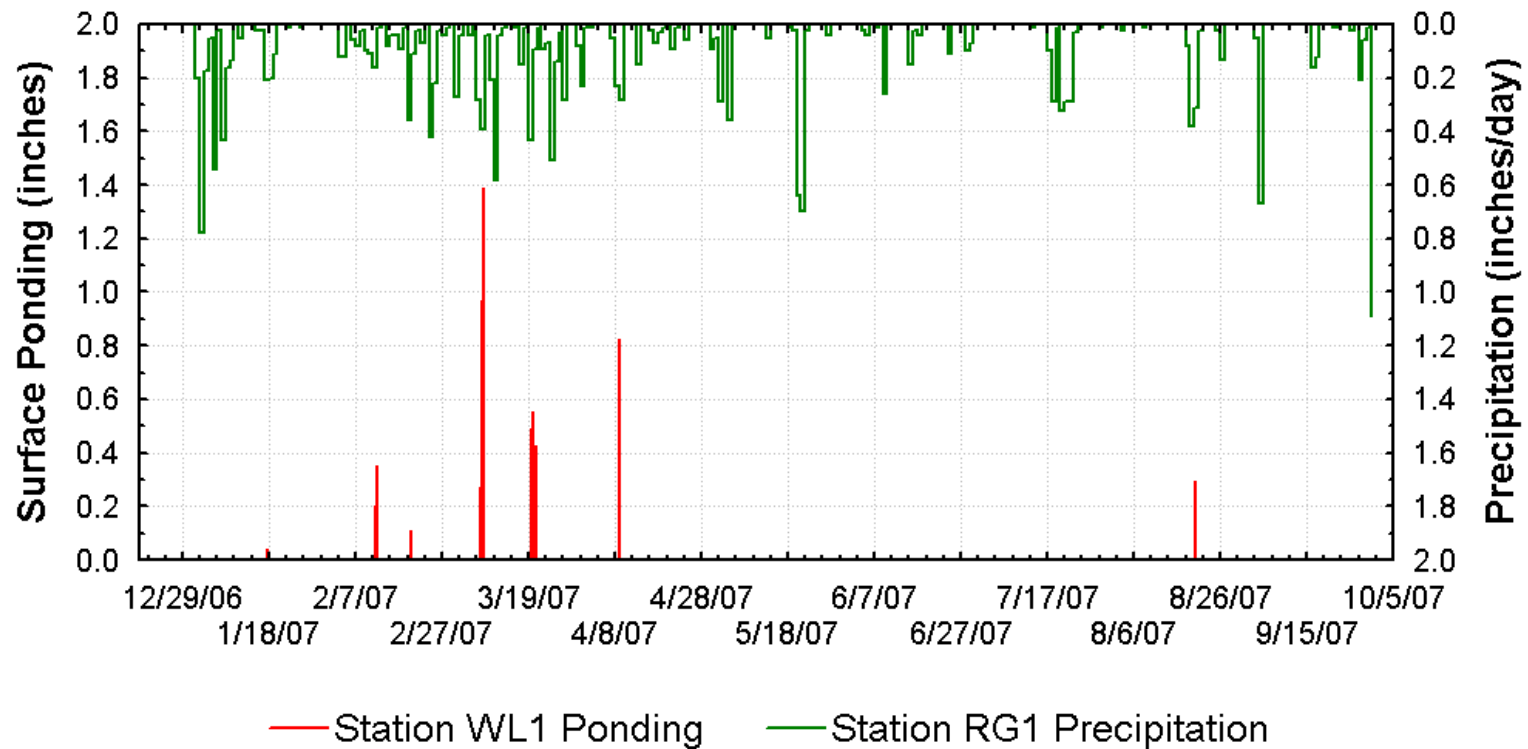
Infiltration Testing



Calculated Infiltration Rate = **6.1 inches/hour**

Surface Ponding

Station WL1 Surface Ponding
Water Year 2007

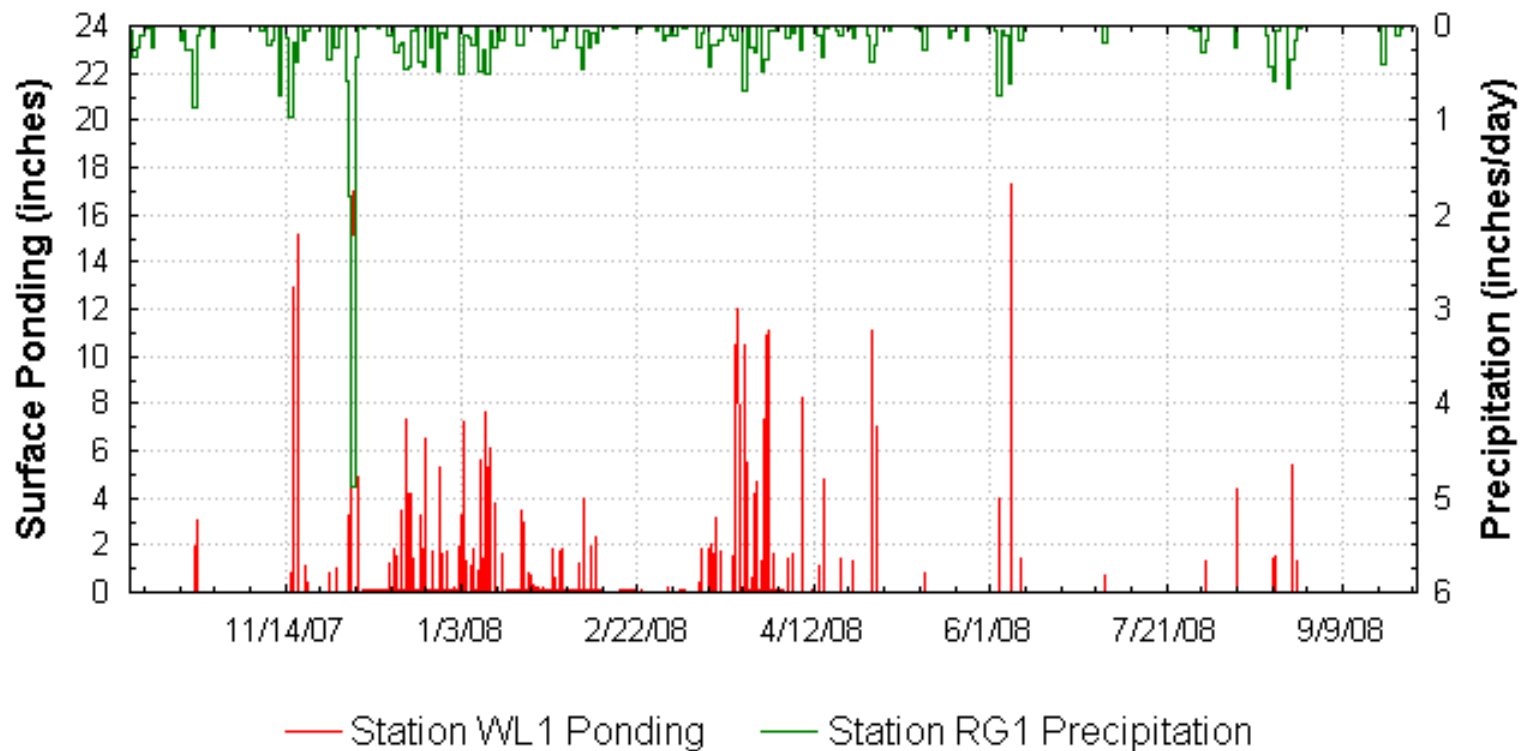




December 1 – 4, 2007
7.58 inches of rain!!!

Surface Ponding

Station WL1 Surface Ponding
Water Year 2008



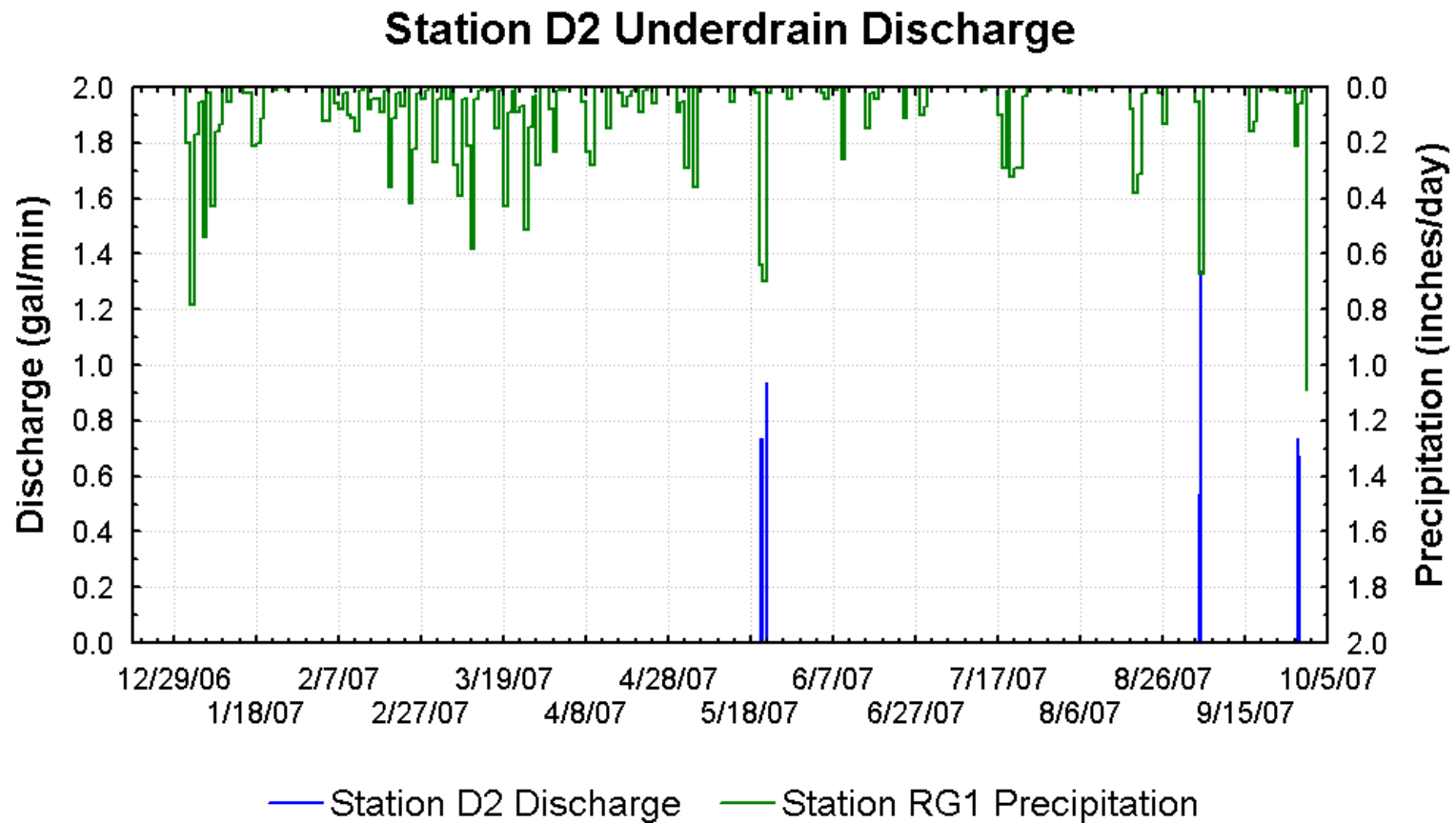
Underdrain Discharge Monitoring

🌿 Design Assumptions

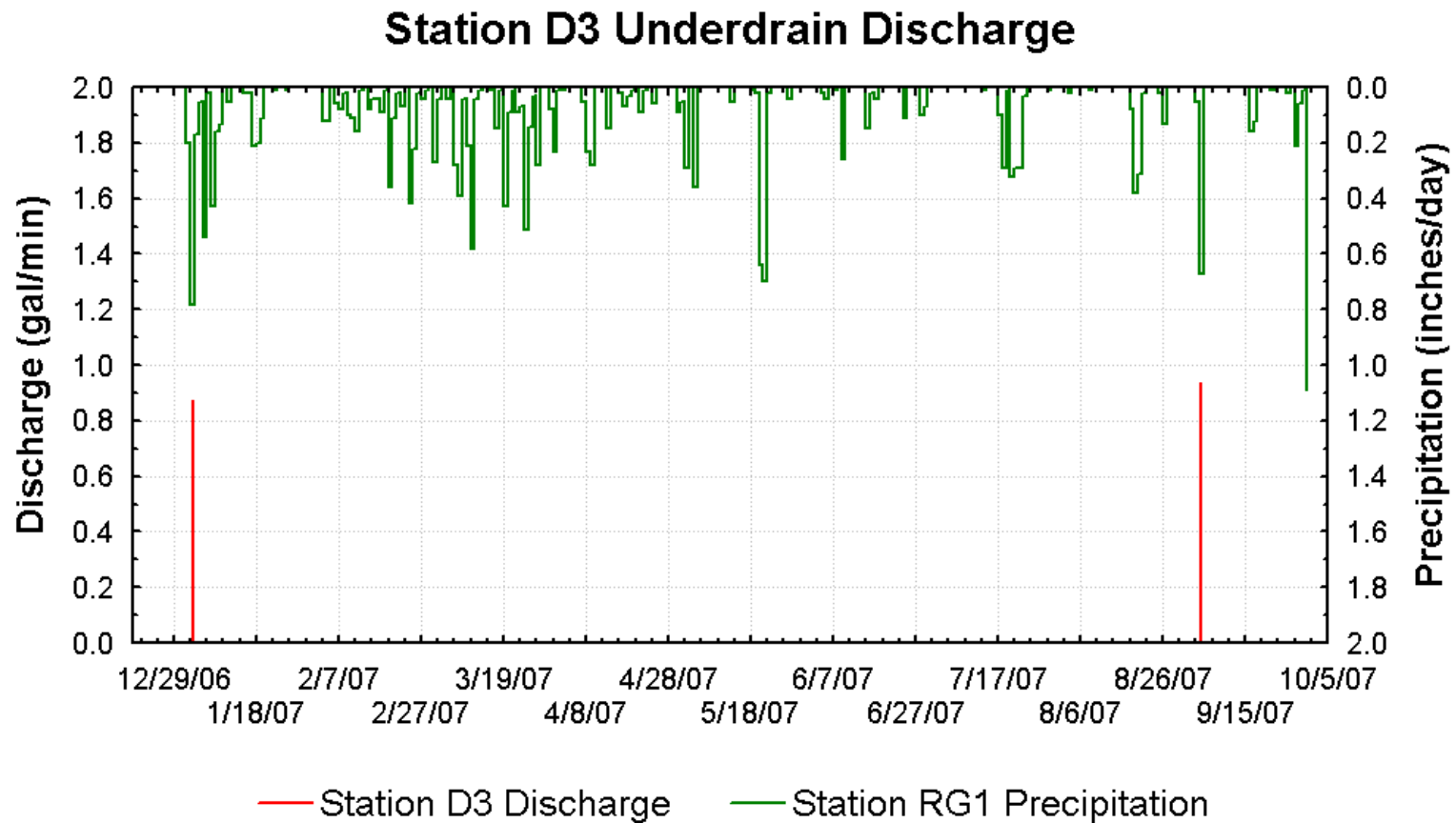
- 🌿 Based on geotechnical reports for the project, the infiltration rate for the underlying till soils was assumed to be so low as to be insubstantial



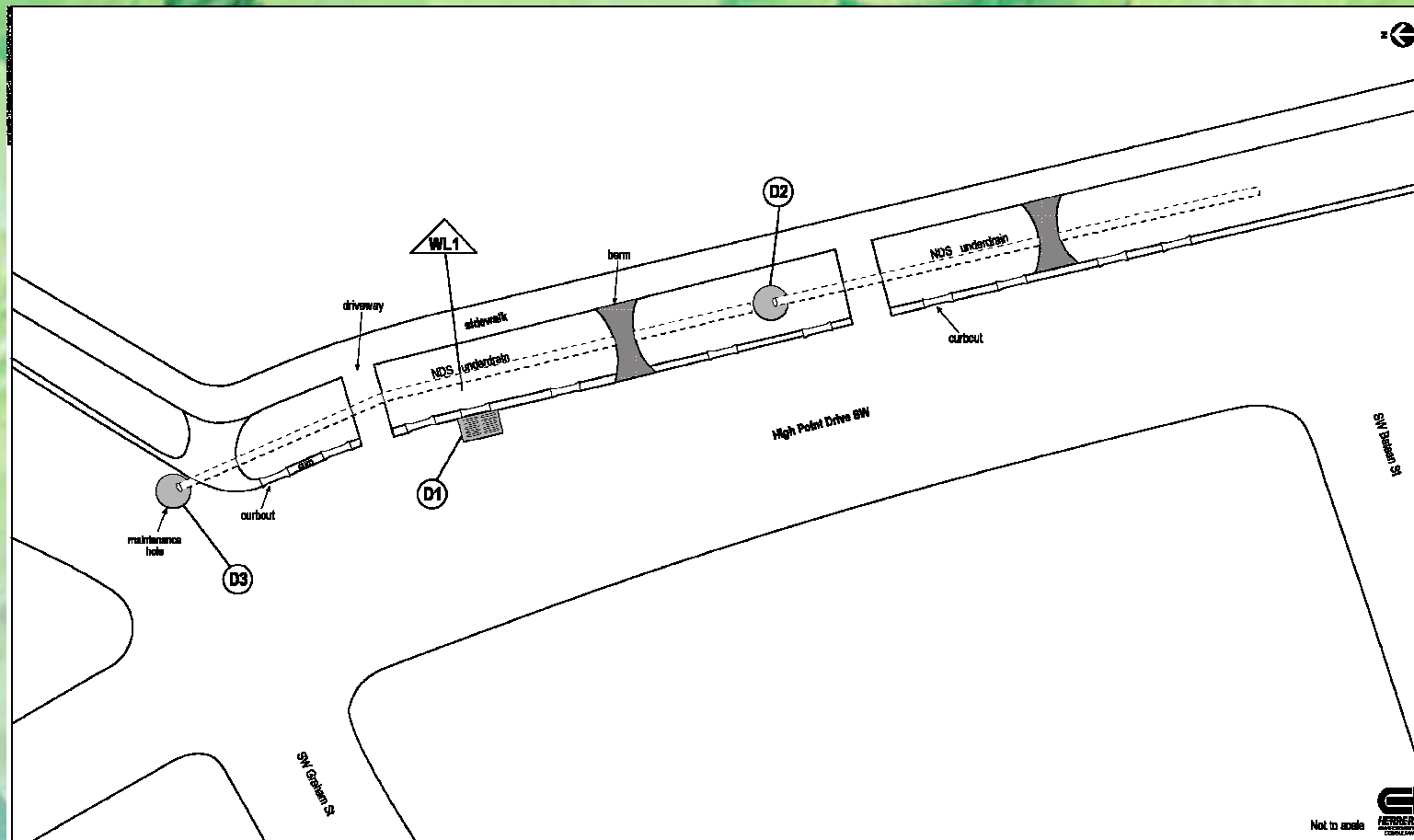
Underdrain Discharge



Underdrain Discharge



HSPF Calibration Monitoring



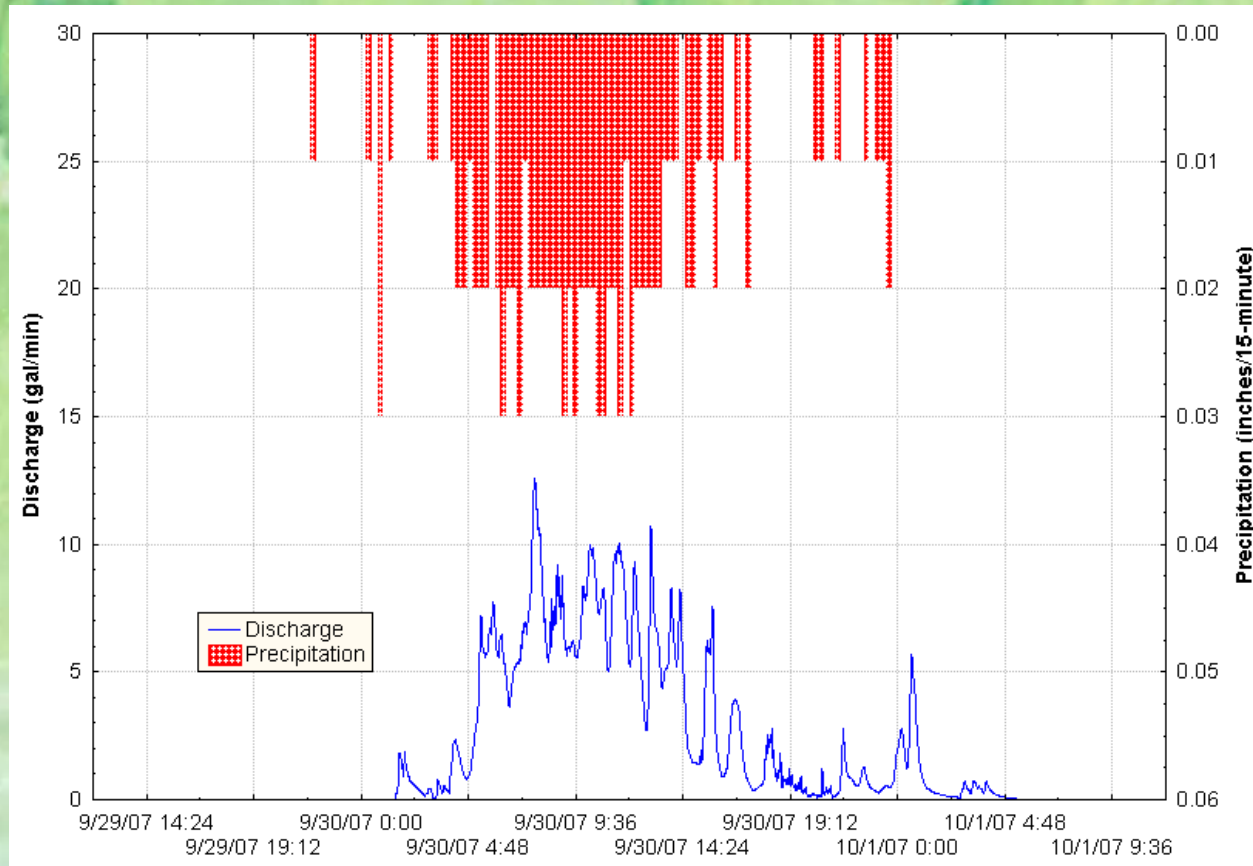
HSPF Calibration Monitoring



HSPF Calibration Monitoring



HSPF Calibration Monitoring



Lessons Learned

- ✿ Monitoring of LID system can provide vital feedback to the design engineer for:
 - ✿ Improving performance
 - ✿ Lowering costs
 - ✿ Determining long-term maintenance requirements
- ✿ Whenever possible, monitoring objectives and required infrastructure should be considered during the design phase
- ✿ Unanticipated changes in site conditions may impact the overall experimental design

Expanded Monitoring



One reference bioretention swale



Collection of flow weighted composite samples for characterizing influent pollutant concentrations



HSPF model calibration monitoring



Two test bioretention swales



Controlled infiltration testing on two occasions



Continuous monitoring:



Discharge from underdrain system



Water level in underdrain system



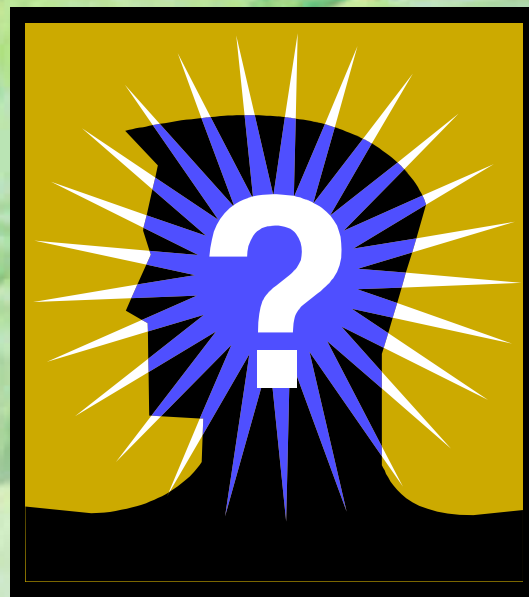
Ponding depth



Precipitation



Collection of time weighted composite samples from the underdrain system for characterizing effluent pollutant concentrations



Expanded Monitoring

